Pleasant and Riddles Lake Aquatic Vegetation Management Plan
2007 Update
St. Joseph County, Indiana

February 20, 2008

Prepared for:
Lakeville Business Owner's Association
PO Box 468
Lakeville, IN 46536

Prepared by:
AQUATIC CONTROL
PO Box 100
Seymour, Indiana 47274

Executive Summary

Pleasant and Riddles lakes are 29-acre and 77-acre lakes, respectively that lie south of Lakeville in St. Joseph County, Indiana. Aquatic Control was contracted by the Lakeville Business Owner's Association (LBOA) to complete aquatic vegetation sampling in order to update their lakewide, long-term integrated aquatic vegetation management plan for Pleasant and Riddles Lakes. Funding for development of this plan was obtained from the Lakeville Business Owner's Association and the Indiana Department of Natural Resources-Division of Fish and Wildlife as part of the Lake and River Enhancement fund (LARE). The update serves as a tool to track changes in the aquatic vegetation community, to adjust the action plan as needed, and to maintain eligibility for additional LARE funds. Items covered include the 2007 sampling results, a review of the 2007 vegetation controls, and updates to the budget and action plans.

Aquatic vegetation is an important component of lakes in Indiana; however, as a result of many factors this vegetation can develop to a nuisance level. Nuisance aquatic vegetation, as used in this paper, describes plant growth that negatively impacts the present uses of the lake including fishing, boating, swimming, aesthetic, and lakefront property values. The primary nuisance species within Pleasant and Riddles Lakes are the exotic plants Eurasian watermilfoil (*Myriophyllum spicatum)* and curlyleaf pondweed (*Potamogetan crispus)*. It is important to manage these lakes as a single entity since they are directly connected by a channel with boat traffic between the two lakes. Any improvements achieved in one lake can easily be negated by reintroduction of exotic invasive species from the other.

The primary recommendation for plant control from the 2006 plan was the use of a combination of herbicides for early season selective control of Eurasian watermilfoil and curlyleaf pondweed throughout the lakes with an objective of keeping these species at or below 5% frequency of occurrence in follow-up surveys. In addition, it was recommended to continue monitoring the aquatic vegetation with spring invasive species mapping and mid to late summer Tier II surveys. It was also noted in the original plan that the primary problem concerning Pleasant and Riddles Lake is their poor water quality. This has led to a decrease in submersed vegetation diversity, dissolved oxygen fluctuations, and dense microscopic algae blooms. Improvement of the water quality should take precedence over submersed vegetation controls. It is vitally important that the recommendations laid out in the diagnostic study be acted upon.

In 2007, the LBOA received a $10,800 grant from LARE to carry out the Eurasian watermilfoil and curlyleaf treatments on Riddles and Pleasant Lakes. The funding was also to be used for spring and mid summer plant sampling and plan update. Spring invasive species mapping was completed by Aquatic Control on May 31, 2007. Eurasian watermilfoil was documented growing in 3.4 acres of Pleasant Lake and no curlyleaf pondweed was detected. The spring survey revealed that Riddles Lake contained 11.75 acres of curlyleaf pondweed and 11.8 acres of Eurasian watermilfoil. On June 14, 2007

Aquatic Control applied Renovate aquatic herbicide on Pleasant Lake to control Eurasian watermilfoil. Riddles Lake was also treated on June 14th with a mixture of Renovate and Aquathol K to control curlyleaf pondweed and Eurasian watermilfoil. The treatment effectively controlled both species. Unfortunately, this treatment was likely completed too late in the season to effectively reduce curlyleaf pondweed prior to turion production. Next season, it is imperative that a contractor is selected and permits are received no later than April 15 in order to complete controls prior to turion formation.

A Tier II survey was completed by Aquatic Control on July 24, 2007 to document changes in the native plant community and document the efficacy of the treatments on both lakes. Curlyleaf pondweed and Eurasian watermilfoil were not detected.

A public meeting was held on October 18, 2007 at the Lakeville Conservation Club to inform the public of the management activities and gain their input on the plan. The primary concern expressed was poor water quality in both lakes. Another meeting was held November 9, 2007 with LARE biologists and the District Fisheries Biologist. Sampling and treatment data along with a potential budget and action plan for 2008 was presented and discussed at this meeting.

The following is a list of recommendations designed to decrease nuisance conditions caused by exotic species while trying to promote native species diversity in Pleasant and Riddles Lakes.

1. Treat Eurasian watermilfoil and curlyleaf pondweed wherever they are detected with a mixture of Renovate 3 (active ingredient triclopyr) and Aquathol K (active ingredient dipotassium endothall salt).
2. Complete a pretreatment invasive species mapping survey prior to any vegetation management in early spring 2008 and continue these surveys through 2011 in order to assess the effectiveness of control techniques.
3. Complete Tier II surveys in mid to late summer in order to document changes in the native community.
4. Continue to assess, adjust, and update the Pleasant and Riddles Aquatic Vegetation Management Plan at least through 2011.
5. Continue to work with area residents, the business community, and local municipalities in an effort to improve watershed practices.

Acknowledgements

Funding for the vegetation sampling and preparation of an aquatic vegetation management plan update was provided by the Lakeville Business Owner's Association and the Indiana Department of Natural Resources Lake and River Enhancement Program. Aquatic Control, Inc. completed the fieldwork, data processing, and map generation. Special thanks are due to Bob Feitz and the Lakeville Business Owner's Association for his help in initiating and completing this project. Special thanks are given to Bob Robertson, Fisheries Biologists for the Indiana Department of Natural Resources-Division of Fish and Wildlife, for their assistance and review of this plan. Special thanks are also given to Gwen White and Angela Sturdevant, Aquatic Biologist from the Lake and River Enhancement Program (LARE) for their review and assistance on this plan. Brendan Hastie is the primary author of this report. The author would like to acknowledge the valuable input from Brian Isaacs, Joey Leach, Nathan Long, and Barbie Huber of Aquatic Control for their field assistance, map generation, review, and editing of this report.

Table of Contents

List of Figures

List of Tables

1.0 INTRODUCTION

This report was created in order to update the Pleasant and Riddles Lakes Aquatic Vegetation Management Plan. The plan update was funded by the Indiana Department of Natural Resources Lake and River Enhancement Program (LARE) and the Lakeville Business Owner's Association. The update serves as a tool to track changes in the vegetation community, to adjust the action plan as needed, and to maintain eligibility for additional LARE funds. Items covered include the 2007 sampling results, a review of the 2007 vegetation controls, and updates to the budget and action plans (there have been no significant changes in lake use or fisheries data since the original plan, so no update is needed). Once reviewed and approved, the update should be included in the original vegetation management plan, following the reference section and prior to the appendix.

Pleasant and Riddles lakes are 29-acre and 77-acre lakes, respectively that lie south of Lakeville in St. Joseph County, Indiana. These lakes have been impacted by nuisance levels of aquatic vegetation. Aquatic vegetation is an important component of lakes in Indiana; however, as a result of many factors this vegetation can develop to a nuisance level. Nuisance aquatic vegetation, as used in this paper, describes plant growth that negatively impacts the present uses of the lake including fishing, boating, swimming, aesthetic, and lakefront property values. The primary nuisance species within Pleasant and Riddles Lakes are the exotic plants Eurasian watermilfoil and curlyleaf pondweed. It is important to manage these lakes as a single entity since they are directly connected by a channel with boat traffic between the two lakes. Any improvements achieved in one lake can easily be negated by reintroduction of exotic invasive species from the other.

2.0 2007 PLANT SAMPLING

Two surveys were completed in 2007 by Aquatic Control in order to document changes in the plant community, map out treatment areas, and measure success or failure of the control techniques. Spring invasive species mapping surveys were completed on May 31, 2007 for both lakes. The purpose of the spring invasive mapping surveys was to identify areas where Eurasian watermilfoil and curlyleaf pondweed were growing so treatment areas could be confirmed and mapped. Tier II surveys were completed on July 24, 2007 for both lakes. These surveys were designed to monitor the health of the native plant community and measure the efficacy of the herbicide treatments.

2.1 Pleasant Lake Sampling Results

2.1.1 Spring Invasive Species Mapping Survey, Pleasant Lake

On May 31, 2007 a spring invasive species mapping survey was completed on Pleasant Lake. A total of 3.4 acres of Eurasian watermilfoil was documented of which 1.4 acres was at 20-30% relative abundance (Figure 1). The densest bed of Eurasian watermilfoil (50-60% abundance) encompassed a 1.0 acre area in the southern end of the lake.

Figure 1. Pleasant Lake, Eurasian watermilfoil areas, May 31, 2007.

2.1.2 Tier II Survey, Pleasant Lake

A Tier II survey was completed on July 24, 2007 by Aquatic Control on Pleasant Lake. This survey was completed according to the LARE Tier II sampling protocol. Many of the same points used in the 2006 survey were used for this survey. Several points from the 2006 Tier II survey that were too deep for plant growth were shifted to shallower areas as recommended by the IDNR. A Secchi disk reading was taken prior to sampling and was found to be 4 feet. Plants were found growing to a maximum depth of 7 feet.

Results of the sampling are listed in Table 1. Thirty points were sampled and native vegetation was present at 20 sites. Common coontail was the only species collected during sampling (Figure 2). Coontail was collected at 66.7% of all the sites. It was found at 100% of the sites between 0 to 5 feet and was collected at 44.4% of the sites between 5 to 10 feet deep. Other species observed but not collected were: watermeal, duckweed, pickerel weed, cattail, spatterdock, white water lily, smartweed, arrow arum,

and water willow. No exotic species were collected or observed during the Tier II survey on Pleasant Lake.

Table 1. Occurrence and abundance of submersed aquatic plants in Pleasant Lake, July 24, 2007.

Occurrence and abundance of submersed aquatic plants in Pleasant Lake							
County:	St. Joseph	Sites with plants:	20	Mean species/site:	0.67		
Date:	7.24.07	Sites with native plants:	20	Standard error (ms/s):	0.0875376		
Secchi (ft):	4	Number of species:	1	Mean native species/site:	0.67		
Maximum plant depth (ft):	7	Number of native species:	1	Standard error (mns/s):	0.0875376		
Trophic status	Mesotrophic	Maximum species/site:	1	Species diversity:	0.00		
Total sites:	30			Native species diversity:	0.00		
All depths (0 to 7 ft)	**Frequency of**	**Rake score frequency per species**				**Plant Dominance**	
Species	**Occurrence**	**0**	**1**	**3**	**5**		
common coontail	66.7	33.3	26.7	10.0	30.0	41.3	
Depth: 0 to 5 ft	**Frequency of**	**Rake score frequency per species**				**Plant Dominance**	
Species	**Occurrence**	**0**	**1**	**3**	**5**		
common coontail	100.0	0.0	25.0	16.7	58.3	73.3	
Depth: 5 to 7 ft	**Frequency of**	**Rake score frequency per species**				**Plant Dominance**	
Species	**Occurrence**	**0**	**1**	**3**	**5**		
common coontail	44.4	55.6	27.8	5.6	11.1	20.0	
Other Species observed: watermeal, duckweed, pickerel weed, cattail, spatterdock, white water lily, smartweed, arrow arumpurple loostrife, and waterwillow							

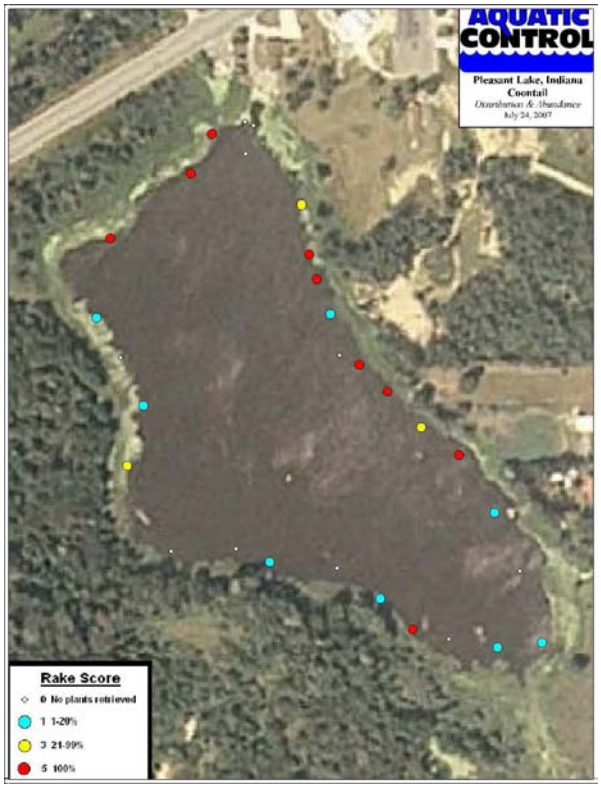

Figure 2. Pleasant Lake, common coontail distribution and density, July 24, 2007.

2.2 Riddles Lake Sampling Results

2.2.1 Spring Invasive Species Mapping Survey, Riddles Lake

On May 31, 2007 a spring invasive species mapping survey was completed on Riddles Lake. A total of 11.75 acres of Eurasian watermilfoil was present along the majority of the shoreline (Figure 3). The areas of least dense Eurasian watermilfoil growth (20-30%) were found along the northwestern (2.70 acres), north central (0.25 acres), and southern (5.50 acres) shorelines. An area of moderately dense growth (50-60%) was observed along the eastern shore and covered 1.80 acres. The area of the densest growth (70-80%) was found on the northern shore and encompassed 1.50 acres.

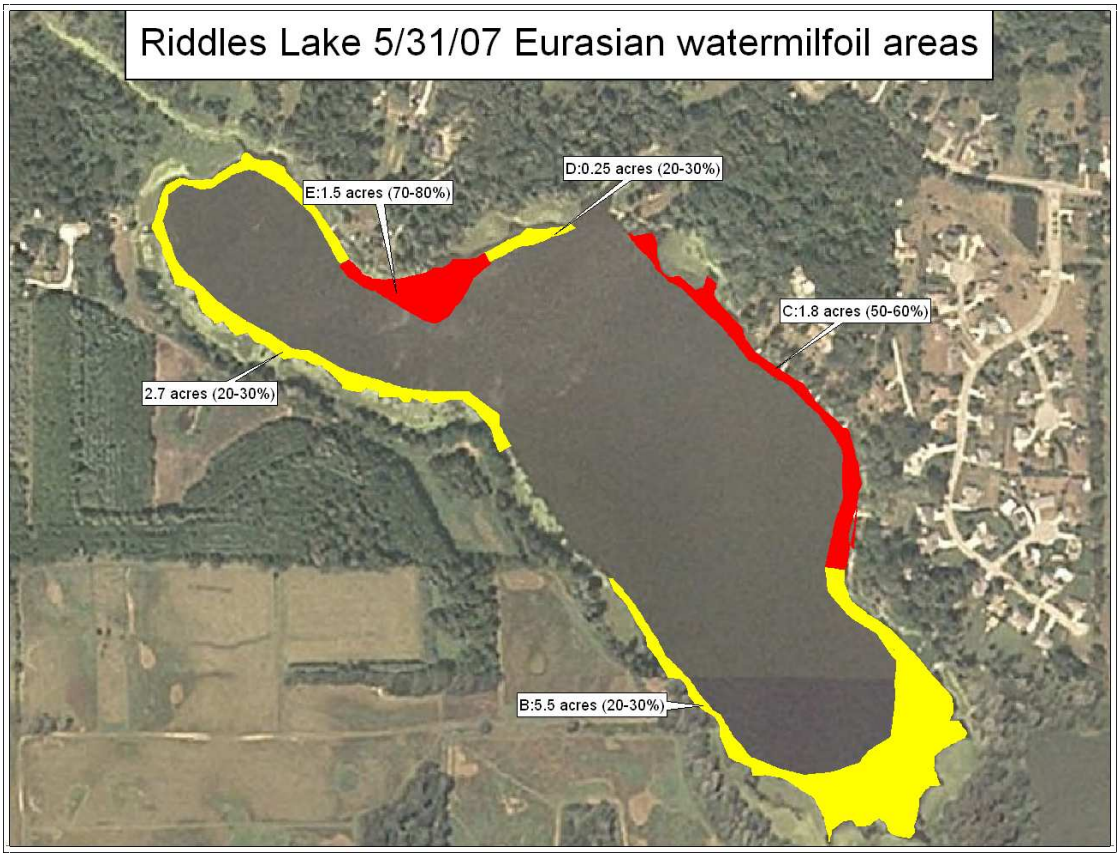

Figure 3. Riddles Lake, Eurasian watermilfoil areas May 31, 2007

Curlyleaf pondweed covered 11.8 acres of Riddles Lake at the time of the 2007 spring invasive species mapping (Figure 4). The densest beds of curlyleaf pondweed (50-60%) were found in the northwestern (0.9 acres), northeastern (0.3 acres), and southern (4.5 acres) shores. Less dense stands (10-20%) were found along the eastern (2.8 acres) and southwestern (0.5 acres) shores. Curlyleaf pondweed was present in low density in the northwestern (1.3 acres) and north central (1.5 acres) littoral zones.

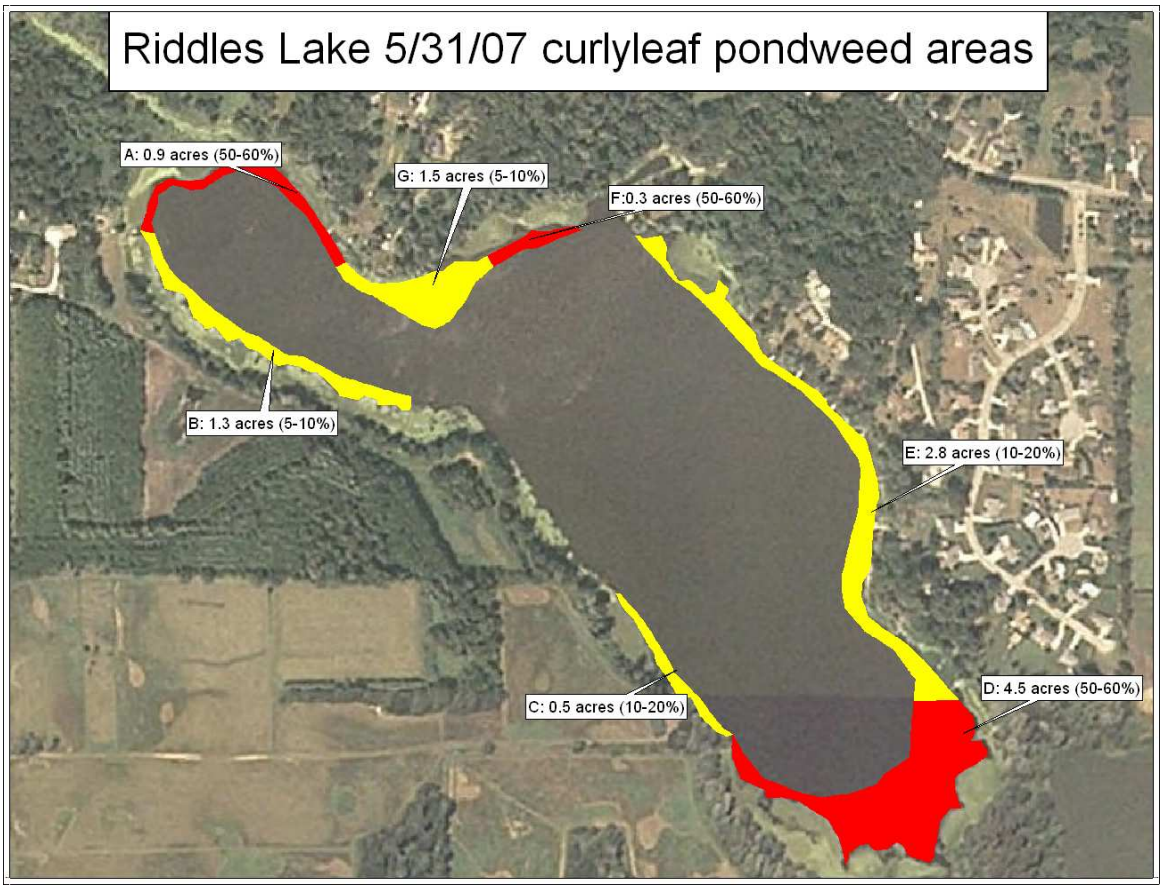

Figure 4. Riddles Lake, curlyleaf pondweed areas May 31, 2007

2.2.2 Tier II-Riddles Lake

A Tier II survey was completed on July 24, 2007 by Aquatic Control on Riddles Lake. This survey was completed according to the LARE Tier II sampling protocol. Many of the same points used in the 2006 survey were used for this survey. Some of the deeper points from the 2006 Tier II survey that did not contain plants were shifted to shallower areas as recommended by the IDNR. A Secchi disk reading was taken prior to sampling and was found to be 1.5 feet. Plants were found growing to a maximum depth of 7 feet.

Results of the sampling are listed in Table 2. Forty points were sampled and native vegetation was present at 26 sites. Common coontail was the only species collected during sampling (Figure 5). Coontail was collected at 65.0% of the sites. It was found at 89.5% of the sites between 0 to 5 feet and at 42.9% of the sites between 5 to 10 feet deep. Other species observed but not collected included: watermeal, duckweed, arrow arum, pickerel weed, cattail, purple loostrife, white water lily, spatterdock, swamp loostrife, and water willow. No submersed exotic species were collected or observed on Riddles Lake during the summer Tier II survey.

Table 2. Occurrence and abundance of submersed aquatic plants in Riddles Lake, July 24, 2007.

Occurrence and abundance of submersed aquatic plants in Riddles Lake							
County:	St. Joseph	Sites with plants:	26		Mean species/site:	0.65	
Date:	7.24.07	Sites with native plants:	26		Standard error (ms/s):	0.0763763	
Secchi (ft):	1.5	Number of species:	1		Mean native species/site:	0.65	
Maximum plant depth (ft):	7	Number of native species:	1		Standard error (mns/s):	0.0763763	
Trophic status	Eutrophic	Maximum species/site:	1		Species diversity:	0.00	
Total sites:	40				Native species diversity:	0.00	
All depths (0 to 7 ft)	**Frequency of**	**Rake score frequency per species**				**Plant Dominance**	
Species	**Occurrence**	**0**	**1**	**3**	**5**		
common coontail	65.0	35.0	37.5	12.5	15.0	30.0	
Depth: 0 to 5 ft	**Frequency of**	**Rake score frequency per species**				**Plant Dominance**	
Species	**Occurrence**	**0**	**1**	**3**	**5**		
common coontail	89.5	10.5	47.4	15.8	26.3	45.3	
Depth: 5 to 7 ft	**Frequency of**	**Rake score frequency per species**				**Plant Dominance**	
Species	**Occurrence**	**0**	**1**	**3**	**5**		
common coontail	42.9	57.1	28.6	9.5	4.8	16.2	
Species observed: watermeal, duckweed, arrow arum, pickerel weed, cattail, purple loostrife, white water lily, spatterdock, swap loostrife, waterwillow							

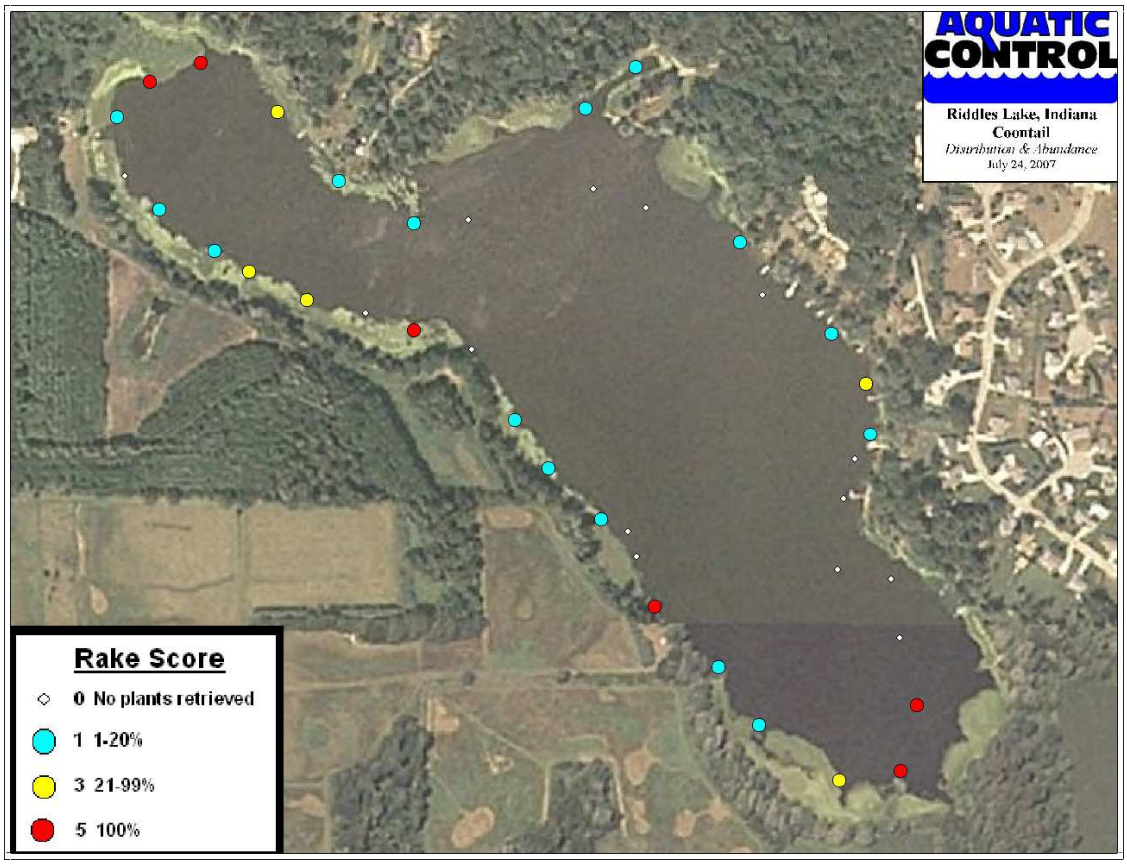

Figure 5. Riddles Lake, common coontail distribution and density, July 24, 2007.

2.3 Plant Sampling Discussion

Pleasant and Riddles Lakes were sampled at the same time due to the belief that exotic species were spreading between the two lakes. The water from Pleasant Lake flows into Riddles Lake via a 3,000 foot channel which experiences boat traffic. Due to the differences in ecosystem and distance between the two lakes, the lakes were sampled separately and the sampling results will be discussed separately.

2.3.1 Pleasant Lake Sampling Discussion

The goal of the 2007 management actions was to decrease the abundance and density of nuisance exotic vegetation and minimize the impacts on the native vegetation in Pleasant Lake. Preserving the native vegetation is especially important in Pleasant Lake due to its low abundance and diversity of native vegetation.

The stated goal in the original aquatic vegetation management plan was to reduce the frequency of Eurasian watermilfoil to 5% or lower. Table 3 shows the Frequency of occurrence of species that were collected in the 2006 summer Tier II survey and the 2007 post treatment Tier II survey. Eurasian watermilfoil decreased from 23.3% frequency of occurrence in 2006 to 0.0% in 2007. The data also shows an increased frequency of occurrence for coontail from 40.0% to 66.7% in 2007. This shift in coontail abundance may be attributed to the moving of sampling points to shallower water. It may also be an indication that coontail is becoming more abundant due to decreased growing stress exerted by exotic species. Native diversity remained low despite the decrease in Eurasian watermilfoil. This is most likely due to poor water quality.

Table 3. Percent of occurrence of species in Pleasant Lake by year.

Species	% of survey sites (8/06)	% of survey sites (7/07)
Eurasian watermilfoil *(Myriophyllum spicatum)*	23.3%	
common coontail *(Ceratophyllum demersum)*	40.0%	66.7%
Slender naiad *(Najas flexillis)*	3.3%	

2.3.2 Riddles Lake Sampling Discussion

As previously mentioned, the goal of the aquatic vegetation management plan was to reduce the Eurasian watermilfoil to less than 5% frequency of occurrence while preserving the condition of the native species. Table 4 shows a comparison of species found in Riddles Lake over the past two years and the frequency at which they occurred. The comparison is from the summer Tier II surveys conducted in 2006 and 2007.

Eurasian watermilfoil decreased from 17.5% in 2006 to 0.0% in 2007. Common coontail appears to have increased from 40% to 65%. As mentioned before, this increase may be attributed to the shifting of sample points from deeper water to areas shallower than 10 feet. The increase in coontail may also be an indication that there is less growing stress exerted upon it by exotic species. Southern naiad, leafy pondweed, and common bladderwort were collected at a single site in 2006, but not collected in 2007. Native diversity did not increase even though the abundance of invasive exotic species had greatly diminished. It may take several years to see improvements in the native plant community and it is important to continue to monitor its progress. It is doubtful that native diversity will fully recover unless the water quality is improved.

Table 4: Percent of occurrence of species in Riddles Lake by year.

Species	% of survey sites (8/06)	% of survey sites (7/07)
Eurasian watermilfoil *(Myriophyllum spicatum)*	17.5%	
common coontail *(Ceratophyllum demersum)*	40.0%	65.0%
southern naiad *(Najas guadalupensis)*	2.5%	
leafy pondweed *(Potamogeton foliosus)*	2.5%	
common bladderwort *(Utricularia vulgaris)*	2.5%	

3.0 2007 VEGETATION CONTROL

On June 14, 2007, a treatment was made on Pleasant Lake to specifically target the invasive exotic species Eurasian watermilfoil (it was planned that curlyleaf pondweed would also be treated, but none was detected). Renovate 3 aquatic herbicide was chosen for use in this treatment because of its selectivity for Eurasian watermilfoil while not harming coontail, the major native species in Pleasant Lake. Renovate was applied to 3.4 acres of Pleasant Lake (Figure 6) via dropper hoses and surface spray. Treatment areas were determined from the spring invasive mapping survey and were marked on handheld GPS units to ensure that herbicide was applied to the correct areas.

Figure 6. Pleasant Lake, Eurasian watermilfoil treatment areas, June 14, 2007.

Riddles Lake was also treated on June 14, 2007. The treatment targeted 11.75 acres of mixed beds of curlyleaf pondweed and Eurasian watermilfoil. A mixture of Renovate and Aquathol K was used in this application. Treatment maps (Figure 7) were made from the spring invasive species mapping data and downloaded to handheld GPS units. The herbicide was applied via dropper hoses and surface spray.

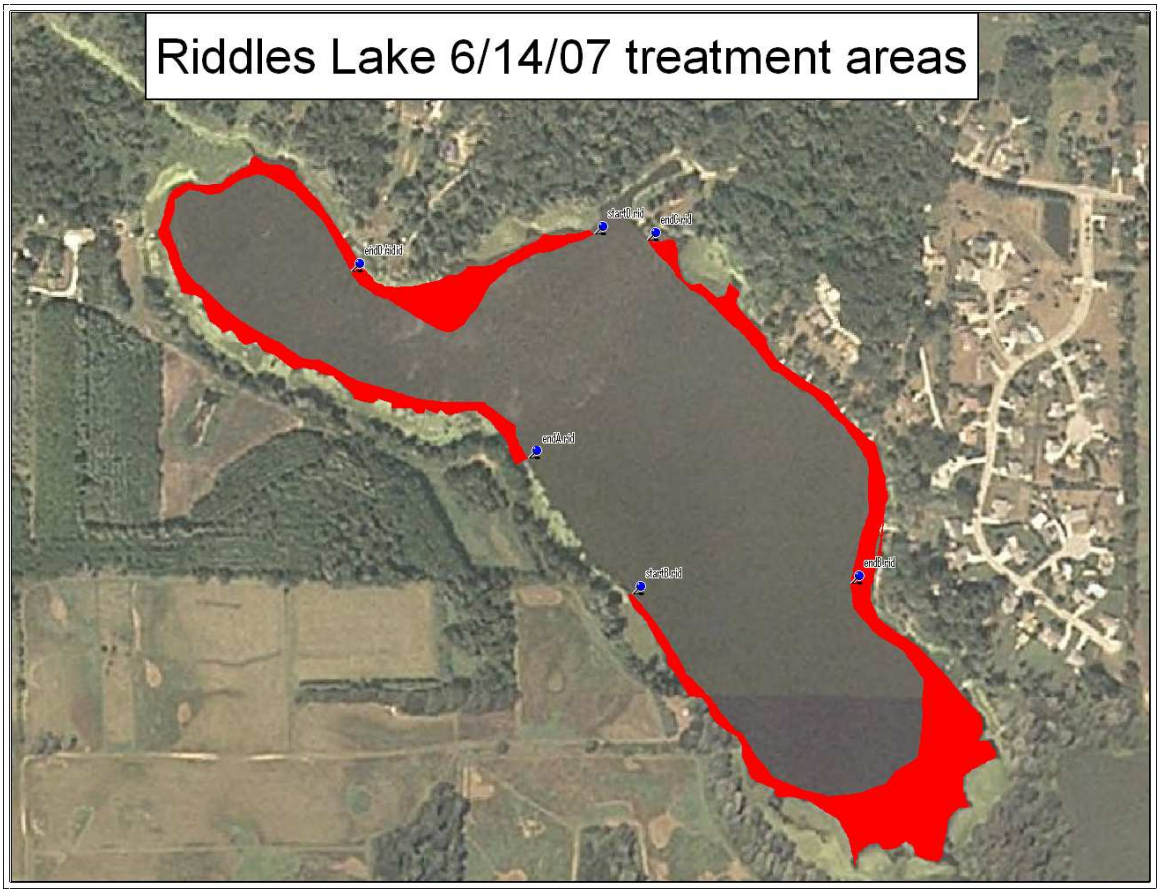

Figure 7. Riddles Lake, Eurasian watermilfoil and curlyleaf pondweed treatment areas, June 14, 2007.

In order to reduce curlyleaf pondweed turion levels, treatments should be completed when water temperatures reach a consistent 50° F. The 2007 treatment likely had no impact on turion levels since it was completed in June. Next season, a contractor must be selected and permits obtained prior to April 15th.

4.0 ACTION PLAN AND BUDGET UPDATE

It is recommended that the LBOA continue with similar plant management controls next season with a few exceptions.

Action taken in 2007 effectively controlled invasive species in both lakes and it is vitally important to continue treatments on invasive species next season. The abundance of Eurasian watermilfoil will likely be reduced in 2008, but the abundance of curlyleaf pondweed will likely be similar due to the late treatment. The treatment was completed too late to prevent turion production in 2007 and must be completed on time in 2008 or little headway on curlyleaf pondweed control will be achieved.

As noted in the original plan, the primary problem concerning Pleasant and Riddles Lake is their poor water quality. This has led to a decrease in submersed vegetation diversity, dissolved oxygen fluctuations, and dense microscopic algae blooms. Improvement of the water quality should take precedence over submersed vegetation controls. It is vitally important that the recommendations laid out in the diagnostic study be acted upon.

A budget for the proposed applications and sampling is provided in Table 5. The budget includes the estimated cost of treatments that should be eligible for funding by LARE. The budget extends for the next four seasons. **It is recommended that LBOA requests $7,000 for the treatment of Eurasian watermilfoil and curlyleaf pondweed. The association should also request $4,000 for plant sampling and plan updates.** When making the funding decision, IDNR should keep in mind that the grant request includes vegetation control in two lakes.

Table 5. Budget estimate for action plan.

	2008	2009	2010	2011
Selective treatment of Eurasian watermilfoil with Renovate herbicide	$7,000	$5,000	$4,000	$3,000
Plant sampling and plan updates (potential LARE funding with 10% match)	$4,000	$4,000	$4,000	$4,000
Total:	**$11,000**	**$9,000**	**$8,000**	**$7,000**

*Request $11,000 from LARE program in 2007.

5.0 PUBLIC INVOLVEMENT

A public meeting was held at the Lakeville Conservation Club on October 18, 2007. The meeting was designed to educate lake users on the benefits of aquatic vegetation, 2007 vegetation controls, and the future of aquatic plant management on Pleasant and Riddle Lakes. The meeting was also used to gain input from lake users concerning their perceptions of aquatic vegetation and satisfaction or dissatisfaction concerning vegetation control techniques. Approximately 8 individuals were in attendance of which 6 filled out a lake use survey. Table 6 shows the results of the survey given during the public meeting. Fifty percent of those surveyed owned property on the lakes and 33.3% had lived on the lakes for more than 10 years. Of those that responded, 66.7% used the lakes for fishing, 50% for boating, and 16.7% said other.

Survey questions concerning problems on the lakes indicated that 100% believed that dredging was needed, 88.3% thought there was poor water quality, and 66.7 felt there were too many aquatic weeds. Questions concerning aquatic vegetation indicated that 66.7% believed vegetation interfered with their lake use, 50% believed there were nuisance levels of aquatic plants, 50% believed vegetation affected their property value, and 83.3% were in favor of continuing vegetation control. Several of the respondents added comments about the levels of E. coli and amount of sewage in the lakes. One respondent felt that mud needed to be removed at the inlets to Riddles Lake. Bob Feitz discussed efforts that are being completed in order to reduce sewage overflow that enters the lake during heavy rain events. Mr. Feitz is currently working with Lakeville city officials to come up with a plan to reduce the influx of overflow entering the lake. The planning process is in its early stages.

Table 6. Results from the public meeting survey

Riddles 83.3% Pleasant 16.7%		
Are you a lake property owner?	Yes 50%	No 50%
Are you currently a member of your lake association?	Yes 33.3%	No 33.3%
How many years have you been at the lake?	2 or Less: 0% 2 to 5: 16.7%	5 to 10: 0% Over 10: 33.3%
How do you use the lake (mark all that apply)	Swimming 0% Boating 50% Fishing 66.7%	Irrigation 0% Drinking water 0% Other? 16.7
Do you have aquatic plants at your shoreline in nuisance quantities?	Yes:50% No:16.7%	No response: 33.3%
Does aquatic vegetation interfere with your use or enjoyment of the lake?	Yes: 66.7% No:16.7%	No response: 16.6%
Does the level of vegetation in the lake affect your property values?	Yes: 50% No: 16.7%	No response: 33.3%
Are you in favor of continuing efforts to control vegetation on the lake?	Yes: 83.3% No: 16.7%	
Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded?	Yes: 83.3% No: 16.7%	
Were you satisfied with the results of the LARE funded invasive treatments this season?	Yes: 66.7% No: 0%	No response: 33.3%
Mark any of these you think are problems on your lake: 0% Too many boats access the lake 0% Use of jet skis on the lake 0% Too much fishing 0% Fish population problem 100% Dredging needed 0 % Overuse by nonresidents 66.7% Too many aquatic plants 0% Not enough aquatic plants 83.3% Poor water quality 0% Pier/funneling problem		

Another topic discussed at the public meeting was the recent discovery of hydrilla (*Hydrilla verticillata*) in Lake Manitou. Hydrilla is an invasive aquatic species that was originally discovered in Florida in the 1960's. There are many characteristics of hydrilla that make it a threat to Indiana waterways. This species can grow in lower light conditions than most native species, grows faster than most native species, and can shade out other species by forming a surface canopy. Hydrilla can be easily confused with native elodea. The best way to distinguish hydrilla from native elodea is that hydrilla typically has five leaves along each whorl along with visible serrated edges along the leaf

margin (Figure 8). What makes controlling the spread of hydrilla difficult is the fact that it can be spread by fragmentation. **That is why it is vitally important that lake users remove all plants and sediment from their boats when entering and leaving the Lakes.** More information about controlling the spread of hydrilla can be found at www.protectyourwaters.net.

Figure 8. Illustration of hydrilla on the left compared to native elodea on the right. Hydrilla typically contains five toothed leaves per whorl while native elodea typically has three leaves per whorl and the teeth are not visible on the leaves (Illustrations provided by Applied Biochemist).

It will be important for the Association to continue to inform users of proper land management practices that have minimal negative impacts on the lakes water quality. This may include discouraging fertilizer use, not disposing of yard waste in or near the lake, and allowing natural vegetation to grow along the shoreline as opposed to concrete seawalls. Residents should also continue to be informed of the benefits of native vegetation on fish populations and water quality. These items can be reinforced in Association newsletters, websites, and at Association meetings. Reduction of nutrient levels in the lakes would likely create dramatic improvements in the diversity of native submersed vegetation.

6.0 APPENDIX UPDATE

6.1 2007 Plant Sampling Data

6.1.1 Pleasant Sampling Data

Lake	Date	Latitude	Longitude	Design	Site	Depth	RAKE	common coontail (*Ceratophyllum demersum*) CEDE4
Pleasant	7.24.07	41.518637	-86.277384		281	3.0	5	5
Pleasant	7.24.07	41.518324	-86.277608		282	4.0	5	5
Pleasant	7.24.07	41.517825	-86.278446		283	6.0	5	5
Pleasant	7.24.07	41.517204	-86.27859		284	7.0	1	1
Pleasant	7.24.07	41.516903	-86.278338		285	6.0	0	
Pleasant	7.24.07	41.516514	-86.278103		286	6.0	1	1
Pleasant	7.24.07	41.516043	-86.278273		287	5.0	3	3
Pleasant	7.24.07	41.515382	-86.277815		288	6.0	0	
Pleasant	7.24.07	41.515401	-86.277135		289	7.0	0	
Pleasant	7.24.07	41.515295	-86.276785		290	6.0	1	1
Pleasant	7.24.07	41.515249	-86.276077		291	7.0	0	
Pleasant	7.24.07	41.51501	-86.275626		292	4.0	1	1
Pleasant	7.24.07	41.514771	-86.275286		293	6.0	5	5
Pleasant	7.24.07	41.5147	-86.274912		294	7.0	0	
Pleasant	7.24.07	41.514631	-86.274401		295	5.0	1	1
Pleasant	7.24.07	41.514668	-86.273936		296	5.0	1	1
Pleasant	7.24.07	41.515226	-86.274172		297	7.0	0	
Pleasant	7.24.07	41.515677	-86.274433		298	6.0	1	1
Pleasant	7.24.07	41.516128	-86.274808		299	3.0	5	5
Pleasant	7.24.07	41.516347	-86.2752		300	6.0	3	3
Pleasant	7.24.07	41.51663	-86.275551		301	3.0	5	5
Pleasant	7.24.07	41.516841	-86.275845		302	5.0	5	5
Pleasant	7.24.07	41.516919	-86.276058		303	6.0	0	
Pleasant	7.24.07	41.517236	-86.276151		304	6.0	1	1
Pleasant	7.24.07	41.517508	-86.276294		305	5.0	5	5
Pleasant	7.24.07	41.517702	-86.276366		306	3.0	5	5
Pleasant	7.24.07	41.518085	-86.276448		307	5.0	3	3
Pleasant	7.24.07	41.518707	-86.27695		308	6.0	0	
Pleasant	7.24.07	41.518487	-86.277033		309	7.0	0	
Pleasant	7.24.07	41.518733	-86.277038		310	6.0	0	

6.1.2Riddles Sampling Data

Lake	Date	Latitude	Longitude	Site	Depth	RAKE	common coontail (*Ceratophyllum demersum*) CEDE4
Riddles	7.24.07	41.508091	-86.266953	311	3.0	5	5
Riddles	7.24.07	41.507912	-86.26758	312	6.0	5	5
Riddles	7.24.07	41.507581	-86.267996	313	6.0	1	1
Riddles	7.24.07	41.507043	-86.267902	314	6.0	0	
Riddles	7.24.07	41.506718	-86.267464	315	7.0	1	1
Riddles	7.24.07	41.506328	-86.26678	316	5.0	1	1
Riddles	7.24.07	41.506137	-86.26635	317	6.0	3	3
Riddles	7.24.07	41.505869	-86.26563	318	6.0	3	3
Riddles	7.24.07	41.505759	-86.264897	319	6.0	0	
Riddles	7.24.07	41.505586	-86.264295	320	4.0	5	5
Riddles	7.24.07	41.505422	-86.263567	321	6.0	0	
Riddles	7.24.07	41.504753	-86.263032	322	7.0	1	1
Riddles	7.24.07	41.504292	-86.262608	323	6.0	1	1
Riddles	7.24.07	41.503818	-86.261951	324	6.0	1	1
Riddles	7.24.07	41.503708	-86.261627	325	7.0	0	
Riddles	7.24.07	41.503475	-86.261517	326	6.0	0	
Riddles	7.24.07	41.502999	-86.261291	327	4.0	5	5
Riddles	7.24.07	41.502441	-86.260487	328	6.0	1	1
Riddles	7.24.07	41.501901	-86.259989	329	5.0	1	1
Riddles	7.24.07	41.501383	-86.258987	330	3.0	3	3
Riddles	7.24.07	41.501468	-86.258218	331	3.0	5	5
Riddles	7.24.07	41.502081	-86.25802	332	4.0	5	5
Riddles	7.24.07	41.502721	-86.258236	333	6.0	0	
Riddles	7.24.07	41.503268	-86.258341	334	5.0	0	
Riddles	7.24.07	41.503357	-86.259009	335	7.0	0	
Riddles	7.24.07	41.504015	-86.258927	336	4.0	0	
Riddles	7.24.07	41.504385	-86.258791	337	7.0	0	
Riddles	7.24.07	41.504613	-86.258599	338	1.0	1	1
Riddles	7.24.07	41.505088	-86.25865	339	4.0	3	3
Riddles	7.24.07	41.505561	-86.259085	340	4.0	1	1
Riddles	7.24.07	41.505928	-86.259947	341	7.0	0	
Riddles	7.24.07	41.50641	-86.26022	342	1.0	1	1
Riddles	7.24.07	41.506745	-86.261398	343	6.0	0	
Riddles	7.24.07	41.506916	-86.262052	344	6.0	0	
Riddles	7.24.07	41.507658	-86.262154	345	2.0	1	1
Riddles	7.24.07	41.508045	-86.261526	346	4.0	1	1
Riddles	7.24.07	41.506631	-86.263613	347	7.0	0	
Riddles	7.24.07	41.506589	-86.264294	348	3.0	1	1
Riddles	7.24.07	41.506984	-86.265229	349	3.0	1	1
Riddles	7.24.07	41.507629	-86.265987	350	4.0	3	3

6.2 2008 Vegetation Control Permit

6.2.1 2008 Pleasant Lake Permit

			Return to: Page 1 of 2
	APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT	**FOR OFFICE USE ONLY**	DEPARTMENT OF NATURAL RESOURCES
	State Form 26727 (R / 11-03)	License No.	Division of Fish and Wildlife
	Approved State Board of Accounts 1987		Commercial License Clerk
	☐ Whole Lake ☒ Multiple Treatment Areas	Date Issued	402 West Washington Street, Room W273
	Check type of permit	Lake County	Indianapolis, IN 46204
	INSTRUCTIONS: Please print or type information		FEE: $5.00

Applicant's Name	Lake Assoc. Name	
Lakeville Business Owner's Association	Lakeville Business Owner's Association	
Rural Route or Street		Phone Number
PO Box 468		574-784-8989
City and State		ZIP Code
Lakeville, IN		46536
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake)	Nearest Town	County		
Pleasant Lake	Lakeville	St. Joseph		
Does water flow into a water supply			☐ Yes	☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area #	1	LAT/LONG or UTM's	Treatment of EWM and CLP throughout lake (areas determined following survey, no more than 7 acres)
Total acres to be controlled	<7.0	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	7	Expected date(s) of treatment(s)	mid April to early May

Treatment method: ☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Combination of Renovate and Aquathol for selective control of Curlyleaf pw and Eurasian WM (see 2006 avmp)

Plant survey method: ☒ Rake ☒ Visual ☐ Other (specify) 2007 survey

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Common coontail		60
Eurasian Watermilfoil	X	20
spatterdock		10
white water lily		10
curlyleaf pondweed	x	0

Page 2 of 2

Treatment Area #		LAT/LONG or UTM's			
Total acres to be controlled		Proposed shoreline treatment length (ft)		Perpendicular distance from shoreline (ft)	
Maximum Depth of Treatment (ft)		Expected date(s) of treatment(s)			

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control.

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY

	Fisheries Staff Specialist
☐ Approved ☐ Disapproved	
	Environmental Staff Specialist
☐ Approved ☐ Disapproved	

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

AQUATIC CONTROL

6.2.2 2008 Riddles Lake Permit

			Return to: Page 1 of 2
	APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT	**FOR OFFICE USE ONLY**	DEPARTMENT OF NATURAL RESOURCES
	State Form 26727 (R / 11-03)	License No.	Division of Fish and Wildlife
	Approved State Board of Accounts 1987	Date Issued	Commercial License Clerk
	☐ Whole Lake ☒ Multiple Treatment Areas		402 West Washington Street, Room W273
	Check type of permit	Lake County	Indianapolis, IN 46204
	INSTRUCTIONS: Please print or type information		FEE: $5.00

Applicant's Name	Lake Assoc. Name	
Lakeville Business Owner's Association	Lakeville Business Owner's Association	
Rural Route or Street		Phone Number
PO Box 468		574-784-8989
City and State		ZIP Code
Lakeville, IN		46536
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake)	Nearest Town	County		
Riddles Lake	Lakeville	St. Joseph		
Does water flow into a water supply			☐ Yes	☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area #	1	LAT/LONG or UTM's	Treatment of EWM and CLP throughout lake (areas determined following survey, no more than 20 acres)
Total acres to be controlled	<20 acres	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	7	Expected date(s) of treatment(s)	mid April to early May

Treatment method: ☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Combination of Renovate and Aquathol for selective control of Curlyleaf pw and Eurasian WM (see 2007 avmp update)

Plant survey method: ☒ Rake ☒ Visual ☐ Other (specify) 2007 Visual and Rake Survey

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Common coontail		30
Eurasian watermilfoil	x	30
Curlyleaf pondweed	x	30
Spatterdock		5
white water lily		5

Page 2 of 2

Treatment Area #		LAT/LONG or UTM's			
Total acres to be controlled		Proposed shoreline treatment length (ft)		Perpendicular distance from shoreline (ft)	
Maximum Depth of Treatment (ft)		Expected date(s) of treatment(s)			

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control.

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY

	Fisheries Staff Specialist
☐ Approved ☐ Disapproved	
	Environmental Staff Specialist
☐ Approved ☐ Disapproved	

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

AQUATIC CONTROL